

WHAT IS CLAIMED IS:

1.           A pressure sensor for measuring a pressure  
of a process fluid, comprising:  
5           a vessel for receiving the process fluid;  
            an electrode integral with an inner wall of  
            the vessel; and  
            a diaphragm that extends at least partially  
            over the electrode and that is  
10           configured to move relative to the  
            electrode in response to the pressure  
            of the process fluid;  
            wherein an electrical capacitance between  
            the electrode and the diaphragm is  
15           related to a pressure of the process  
            fluid.
2.           The pressure sensor of claim 1 wherein the  
            electrode extends partially around the  
20           inner wall of the vessel.
3.           The pressure sensor of claim 2 wherein the  
            diaphragm extends partially around the  
            inner wall of the vessel.  
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4.           The pressure sensor of claim 1 and further  
            comprising:  
            a temperature sensor integral with the  
            inner wall to measure a fluid

temperature and to generate a  
temperature signal indicative of the  
fluid temperature.

- 5    5.        The pressure sensor of claim 4 and further  
         comprising:  
         processing electronics adapted to produce a  
         pressure signal that is a function of  
         the temperature signal.
- 10           6.        The pressure sensor of claim 1 wherein the  
         electrode extends completely around  
         the inner wall of the vessel.
- 15           7.        The pressure sensor of claim 6 wherein the  
         diaphragm extends completely around  
         the inner wall of the vessel.
8.        The pressure sensor of claim 1 and further  
20           comprising:  
         a measurement circuit adapted to produce a  
         pressure signal based on electrical  
         capacitance.
- 25           9.        The pressure sensor of claim 1 and further  
         comprising:  
         a wireless transceiver mounted to the  
         housing and electrically connected  
         with the annular capacitor for

wireless transmitting the pressure signal to a control and/or monitoring system.

- 5    10.        The pressure sensor of claim 1 wherein the  
                 electrode and the diaphragm form a  
                 first capacitor, and further  
                 comprising:  
                 a flow restrictive element extending from  
10               the inner wall of the vessel into the  
                 process fluid;  
                 a second capacitor having a second  
                 electrode integral with the inner wall  
                 and a second diaphragm that extends at  
15               least partially over the electrode and  
                 that is configured to move relative to  
                 the electrode in response to the  
                 pressure of the process fluid;  
                 wherein the flow restrictive element is  
20               positioned between the first capacitor  
                 and the second capacitor to measure a  
                 first capacitance and a second  
                 capacitance such that a difference  
                 between the first and the second  
25               capacitances is a differential  
                 capacitance representative of a  
                 differential pressure of the process  
                 fluid.

11.           The pressure sensor of claim 1 wherein the diaphragm extends away from the inner wall into the process fluid.
- 5   12.           The pressure sensor of claim 1 wherein the diaphragm is flush with the inner wall of the fluid flow conduit and the electrode is recessed into the inner wall.
- 10   13.           A differential pressure sensor for measuring a differential pressure of a process fluid in a conduit, comprising:
- a flow restriction element integral with an inner wall of the conduit and adapted to produce a pressure drop when placed
- 15           in-line with a fluid flow;
- a first capacitor integral with the inner wall of the conduit and positioned upstream from the flow restriction element and in-line with the process
- 20           fluid; and
- a second capacitor integral with the inner wall of the conduit and positioned downstream from the flow restriction element and in-line with the process
- 25           fluid;
- wherein in a first capacitance and a second capacitance are related to the pressure of the process fluid.

14. The differential pressure sensor of claim 13, further comprising:

5 processing electronics adapted to produce a flow rate signal that is indicative of a direction and a flow rate of the process fluid as a function of the first and the second capacitances.

10 15. The differential pressure sensor of claim 13, wherein the first capacitor and the second capacitor each comprises:

an electrode integral with an inner wall of the conduit; and

15 a diaphragm that extends at least partially over the electrode and that is configured to move relative to the electrode in response to the pressure of the process fluid;

20 wherein an electrical capacitance between the electrode and the diaphragm is related to the pressure of the process fluid.

25 16. The differential pressure sensor of claim 13 wherein the flow restriction element has a narrow fluid flow passageway extending between symmetric first and second throat portions.

17. The differential pressure sensor of claim 13, further comprising:

5 a temperature sensor adapted to sense at least one of a temperature of the fluid flow and an operating temperature of the pressure sensor and to produce a temperature signal that is indicative of the sensed temperature.

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18. The differential pressure sensor of claim 17 wherein the flow rate signal is further a function of the temperature signal.

15 19. The differential pressure sensor of claim 13 wherein each of the first capacitor and the second capacitor extend at least partially around the inner wall of the conduit.

20 20. The differential pressure sensor of claim 13 wherein each of the first capacitor and the second capacitor extend entirely around the inner wall of the conduit.

25 21. A flow meter adapted to measure a pressure and a flow direction of a process fluid within a conduit the flow meter comprising:

a first capacitive pressure sensor adapted  
to generate a first capacitance  
signal;  
a second capacitive pressure sensor adapted  
5 to generate a second capacitance  
signal; and  
a flow restrictive element positioned  
within the conduit and between the  
first and the second capacitive  
10 pressure sensors and adapted to cause  
a pressure drop in the conduit;  
wherein the first and the second  
capacitance signals are representative  
of a first and a second pressure of  
15 the process fluid such that the first  
and the second capacitance signals may  
be subtracted to calculate a  
differential capacitance  
representative of a differential  
20 pressure.

22. The flow meter of claim 21 wherein each  
capacitive pressure sensor comprises:  
an electrode integral to an inner wall of  
25 the conduit; and  
a diaphragm that extends at least partially  
over the electrode and that is  
configured to move relative to the

electrode in response to the pressure  
of the process fluid;

wherein in an electrical capacitance  
between the electrode and the  
diaphragm is related to the pressure  
of the process fluid.

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23. The flow meter of claim 22 wherein the  
diaphragm is flush with the inner wall of the fluid  
flow conduit and the electrode is recessed into the  
wall.

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24. The flow meter of claim 22 wherein the  
diaphragm extends into the process fluid and the  
electrode is flush with the inner wall of the  
conduit.

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25. The flow meter of claim 22 wherein the  
electrode extends partially around the inner wall of  
the conduit.

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26. The flow meter of claim 25 wherein the  
diaphragm extends partially around the wall of the  
conduit.

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27. The flow meter of claim 21 further  
comprising:

a temperature sensor integral with the wall  
to measure a fluid temperature and to



generate a temperature signal  
indicative of the fluid temperature.

28. The flow meter of claim 27 further  
5 comprising:

processing electronics adapted to produce a  
pressure signal that is a function of  
the temperature signal.

10 29. The flow meter of claim 22 wherein the  
electrode extends completely around the inner wall of  
the conduit.

30. The flow meter of claim 29 wherein the  
15 diaphragm extends completely around the inner wall of  
the conduit.

31. The flow meter of claim 22 further  
comprising:

20 a measurement circuit adapted to produce a  
pressure signal based on the  
electrical capacitance.

32. The flow meter of claim 21 further  
25 comprising:

a wireless transceiver mounted to the  
conduit and electrically connected  
with the first and second capacitive  
pressure sensors for wireless

transmission of the differential pressure to a control and/or monitoring system.

5 33. The flow meter of claim 21 further comprising:

10 a temperature sensor embedded within an insulator of the first capacitive pressure sensor to measure a device temperature and to generate a temperature signal indicative of the device temperature.